

CLAIMS

What is claimed is:

1. A method of handing off a mobile node from an old sub-network router to a new sub-network router in an Internet Protocol based wireless access network, comprising:

5 using information from a lower layer of the OSI (Open Systems Interconnection) model to notify the mobile node that a connection with the old sub-network router will be discarded within a predetermined amount of time;

obtaining a new care-of address for the mobile node from the new sub-network router;

10 sending a request message from the mobile node to a base node via the new sub-network router requesting a new binding;

creating a new care-of address binding in the base node;

issuing a reply message from the base node to the mobile node via the new sub-network router indicating that the new care-of address binding has been created; and

15 synchronizing a transfer of old care-of address data packets from the base node to the mobile node.

2. The method according to claim 1, wherein the request message is a mobile node registration request message and the reply message is a mobile node registration reply message.

3. The method according to claim 2, wherein the base node is a home agent and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

deleting an old care-of address binding from the home agent; and

5 issuing a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

4. The method according to claim 3, wherein the mobile node does not receive the deregistration reply message before a predetermined time, the synchronizing step further comprising:

10 sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

15 issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

20 5. The method according to claim 2, wherein the base node is a home agent and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

5 issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

deleting an old care-of address binding from the home agent; and

10 issuing a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

6. The method according to claim 2, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing two sub-
15 networks simultaneously, the synchronizing step comprising:

sending a deregistration binding update message from the mobile node to a correspondent node via the old sub-network router;

deleting an old care-of address binding from the correspondent node;

issuing a deregistration binding acknowledgment message from the correspondent
20 node to the mobile node via the old sub-network router;

sending a binding update message from the home agent to the correspondent node;
and

creating a new care-of address binding in the correspondent node.

7. The method according to claim 6, wherein the mobile node does not receive the deregistration binding acknowledgment message before the old wireless sub-network has deteriorated beyond a certain point, the synchronizing step further comprising:

5 sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

10 issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

15 8. The method according to claim 2, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

20 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

5 sending a binding update message from the home agent to a correspondent node; and
 creating a new care-of address binding in the correspondent node.

9. The method according to claim 2, wherein the base node is a gateway foreign agent and the mobile node is capable of accessing two sub-networks simultaneously, the
10 synchronizing step comprising:

 deleting an old care-of address binding from the gateway foreign agent; and
 issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

15 10. The method according to claim 9, wherein the mobile node does not receive the deregistration binding acknowledgment message before a predetermined time, the synchronizing step further comprising:

20 sending a binding update message from the mobile node to the old sub-network router;

 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

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11. The method according to claim 2, wherein the base node is a gateway foreign agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

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sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

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forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

deleting an old care-of address binding from the gateway foreign agent; and

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issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

12. The method according to claim 1, wherein the request message is a binding update message and the reply message is a binding acknowledgment message.

13. The method according to claim 12, wherein the base node is a home agent and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising issuing:

sending a deregistration binding update message from the mobile node to the home agent via the old sub-network router;

deleting an old care-of address binding from the home agent; and

sending a deregistration reply message from the home agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

14. The method according to claim 13, wherein the mobile node does not receive the deregistration reply message before the old wireless sub-network has badly deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

5 15. The method according to claim 12, wherein the base node is a home agent and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

sending a binding update message from the mobile node to the old sub-network router;

10 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

15 sending a deregistration binding update message from the mobile node to the home agent via the old sub-network router;

deleting an old care-of address binding from the gateway foreign agent; and

20 issuing a deregistration reply message from the gateway foreign agent to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

16. The method according to claim 12, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

5 sending a deregistration binding update message from the mobile node to a correspondent node via the old sub-network router;

deleting an old care-of address binding in the correspondent node;

issuing a deregistration binding acknowledgment message from correspondent node to the mobile node via the old sub-network router;

10 sending a binding update message from the mobile node to the correspondent node via the new sub-network router;

creating a new care-of address binding in the correspondent node; and

issuing a binding acknowledgment message from the correspondent node to the mobile node via the new sub-network router.

15 17. The method according to claim 16, wherein the mobile node does not receive the deregistration binding acknowledgment message before the old wireless sub-network has deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

20 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

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18. The method according to claim 12, wherein a route optimization function is used, the base node is a home agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

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sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

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forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

sending a binding update message from the mobile node to the correspondent node via the new sub-network router;

creating a new care-of address binding in the correspondent node; and

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issuing a binding acknowledgment message from the correspondent node to the mobile node via the new sub-network router.

19. The method according to claim 12, wherein the base node is a mobility anchor point and the mobile node is capable of accessing two sub-networks simultaneously, the synchronizing step comprising:

5 sending a deregistration binding update message from the mobile node to the mobility anchor point via the old sub-network router;

deleting an old care-of address binding from the mobility anchor point; and

issuing a deregistration binding acknowledgment message from the mobility anchor point to the mobile node via the old sub-network router.

10 20. The method according to claim 19, wherein the mobile node does not receive the deregistration binding acknowledgment before the old wireless sub-network has deteriorated beyond a certain point, the synchronizing step further comprising:

sending a binding update message from the mobile node to the old sub-network router;

15 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

20 forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

21. The method according to claim 12, wherein the base node is a gateway foreign agent, and the mobile node is capable of accessing only a single sub-network at a time, the synchronizing step comprising:

5 sending a binding update message from the mobile node to the old sub-network router;

creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router;

10 forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address;

sending a deregistration binding update message from the mobile node to the mobility anchor point via the old sub-network router;

deleting an old care-of address binding from the mobility anchor point; and

15 issuing a deregistration binding acknowledgment message from the mobility anchor point to the mobile node via the old sub-network router.

22. An Internet Protocol based wireless access network, comprising:

20 a mobile node adapted to obtain a new care-of address from a new sub-network router and to issue a request message via the new sub-network router requesting a new binding upon being notified from a lower layer of the OSI (Open Systems Interconnection)

model that a connection with an old sub-network router will be discarded within a predetermined amount of time; and

a base node adapted to create the new care-of address binding upon receiving the request message from the mobile node and to issue a reply message to the mobile node via the new sub-network router indicating that the new care-of address binding has been created;

wherein the mobile node and the base node are further adapted to transfer old care-of address data packets from the base node to the mobile node in a synchronized manner.

23. The network according to claim 22, wherein the request message is a mobile node registration request message and the reply message is a mobile node registration reply message.

24. The network according to claim 22, wherein the request message is a binding update message and the reply message is a binding acknowledgment message.

25. The network according to claim 22, wherein a route optimization function is used.

26. The network according to claim 22, wherein the mobile node is capable of accessing two sub-networks simultaneously.

27. The network according to claim 22, wherein the mobile node is capable of accessing only a single sub-network at a time.

28. The network according to claim 22, wherein the base node is a home agent.

29. The network according to claim 22, wherein the base node is a gateway foreign agent.

30. The network according to claim 22, wherein the base node is a mobility anchor point.

31. The network according to claim 22, wherein the base node is further adapted to delete an old care-of address binding and issue a deregistration reply message to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

32. The network according to claim 22, wherein the mobile node is further adapted to send a deregistration binding update message to the base node via the old sub-network router, and the base node is further adapted to delete an old care-of address binding therefrom, and issue a deregistration binding acknowledgment message to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

33. The network according to claim 22, wherein the mobile node is further adapted to send a binding update message to the old sub-network router, and the old sub-network router is adapted to create a binding cache entry linking the old care-of address to the new care-of address, issue a binding acknowledgment message to the mobile node via the new sub-network router, and forward substantially all old care-of address data packets stored or arriving thereat to the new care-of address.

34. The network according to claim 22, wherein the mobile node is further adapted to send a deregistration binding update message to a correspondent node via the old sub-network router, and the correspondent node is adapted to delete an old care-of address binding therefrom, and issue a deregistration binding acknowledgment message to the mobile node via the old sub-network router.

35. The network according to claim 22, wherein the base node is further adapted to send a binding update message to a correspondent node, and the correspondent node is adapted to create a new care-of address binding therein.

36. A method of handing off a mobile node from an old sub-network router to a new sub-network router in an Internet Protocol based wireless access network, comprising:

using information from a lower layer of the OSI (Open Systems Interconnection) model to notify the mobile node that a connection with the old sub-network router will be discarded within a predetermined amount of time;

obtaining a new care-of address for the mobile node from the new sub-network router;

sending a request message from the mobile node to a base node via the new sub-network router requesting a new binding, the base node being predetermined one of a home agent, a gateway foreign agent, and a mobility anchor point;

creating a new care-of address binding in the base node;

issuing a reply message from the base node to the mobile node via the new sub-network router indicating that the new care-of address binding has been created; and

synchronizing a transfer of old care-of address data packets from the base node to the mobile node.

37. The method according to claim 36, wherein the request message is a mobile node registration request message and the reply message is a mobile node registration reply message.

38. The method according to claim 36, wherein the request message is a binding update message and the reply message is a binding acknowledgment message.

39. The method according to claim 36, wherein a route optimization function is used.

40. The method according to claim 36, wherein the mobile node is capable of
5 accessing two sub-networks simultaneously.

41. The method according to claim 36, wherein the mobile node is capable of
accessing only a single sub-network at a time.

42. The method according to claim 36, wherein the synchronization step
10 comprises:

deleting an old care-of address binding from the base node; and

issuing a deregistration reply message from the base node to the mobile node via the
old sub-network router indicating that the old care-of address binding has been deleted.

43. The method according to claim 36, wherein the synchronization step
15 comprises:

sending a deregistration binding update message from the mobile node to the base
node via the old sub-network router;

20 deleting an old care-of address binding from the base node; and

issuing a deregistration binding acknowledgment message from the base node to the mobile node via the old sub-network router indicating that the old care-of address binding has been deleted.

5 44. The method according to claim 36, wherein the synchronization step comprises:

 sending a binding update message from the mobile node to the old sub-network router;

10 creating a binding cache entry in the old sub-network router linking the old care-of address to the new care-of address;

 issuing a binding acknowledgment message from the old sub-network router to the mobile node via the new sub-network router; and

 forwarding substantially all old care-of address data packets stored or arriving at the old sub-network router to the new care-of address.

15 45. The method according to claim 36, wherein the synchronization step comprises:

 sending a deregistration binding update message from the mobile node to a correspondent node via the old sub-network router;

20 deleting an old care-of address binding from the correspondent node; and

 issuing a deregistration binding acknowledgment message from the correspondent node to the mobile node via the old sub-network router.

46. The method according to claim 36, wherein the synchronization step comprises:

sending a binding update message from the base node to a correspondent node; and

5 creating a new care-of address binding in the correspondent node.